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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

SERVICE ENGINEER (Mach. Tools & Access.) 5-83.988

B-453 or S-183

U. S. Employment Service in
Cooperation with the
California, Colorado, Illinois, Michigan,
Minnesota, North Carolina, Ohio, Pennsylvania,
Texas, and Washington State Employment Services

U. S. DEPARTMENT OF LABOR
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

SERVICE ENGINEER (Mach. Tools & Access.) 5-83.988

B-453

Summary

The General Aptitude Test Battery, B-1002A, was administered during the period 1956-1959 to 50 males employed as Service Engineers 5-83.988 at 29 Do-All Companies located in various cities in ten States and two provinces in Canada. The Criterion consisted of broad category ratings assigned by the Service Manager. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes G-Intelligence, S-Spatial Aptitude, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Service Engineer 5-83-988 - B-453

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Service Engineer 5-83.988.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-453

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-J CB-1-I	100	G	Part 3 Part 4 Part 6	95
S	CB-1-F CB-1-H	90	S	Part 3	85
M	CB-1-M CB-1-N	90	M	Part 9 Part 10	85

Effectiveness of Norms

The data in Table VI indicate that 11 of the 15 poor workers, or 73 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 73 percent of the poor workers would

not have been hired if the recommended test norms had been used in the selection process. Moreover, 30 of the 34 workers who made qualifying test scores, or 88 percent, were good workers.

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Service Engineer 5-83.988.

II. Sample

The General Aptitude Test Battery, B-1002A, was administered at various times during the period 1956-1959 to 56 males employed as Service Engineers 5-83.988 by Continental Machines, Incorporated, of Savage, Minnesota, and by various affiliated Do-All Companies in several cities of the United States and Canada. The final sample consisted of 50 males employed by 29 Do-All Companies located in the following cities: Atlanta, Baltimore, Buffalo, Charlotte, Chicago, Cincinatti, Cleveland, Dallas, Dayton, Denver, Detroit, Grand Rapids, Hartford, Houston, Indianapolis, Kansas City, Los Angeles, Minneapolis, Montreal, Nashville, New York, Nutley (New Jersey), Philadelphia, Pittsburgh, Rockford, St. Louis, San Francisco, Toledo, and Toronto. Although GATB data were obtained for several Service Engineers 5-83.988 tested in Ohio, Pennsylvania, and Texas, these individuals were not included in the final sample because they had not completed the training period at the time the data were analyzed.

The company prefers to hire applicants who are between the ages of 25 and 45 years, have completed high school, and have some experience in mechanical or related occupations. None of the applicants are selected with the use of tests. The company maintains a six to eight week training program for new employees at the factory. After that period, workers are expected to be able to perform all job duties. All workers in the sample had at least six months of experience in this occupation.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Service Engineer 5-83.988
N = 50

	M	σ	Range	r
Age (years)	32.3	7.6	21-54	-.113
Education (years)	11.7	1.4	8-15	.114
Experience (months)	24.4	20.2	6-84	.005

There are no significant correlations with the criterion for age, education or experience. The data in Table II indicate that this sample is suitable for test development purposes with respect to age, education and experience.

III. Job Description

Job Title: Service Engineer, 5-83.988

Job Summary: Inspects, diagnoses and appraises customers' surface grinders, band saws, contour machines, power saws and other machines to make adjustments, estimate costs, and make necessary repairs and replacement of parts to continue trouble free production.

Work Performed: Estimates costs: Studies assignment from office manager by checking service on machines owned by firms requesting service. Inspects and runs machine noting malfunctioning and symptoms to make correct diagnosis and appriasal based on judgment and knowledge. Informs customer of cost on other than guaranteed service jobs.

Replaces and adjusts parts: Orders all necessary parts; tears down machine to remove defective parts and replaces such parts according to instructions on installation sheets. Checks own work; makes adjustments and runs machine to make sure that it functions properly.

Prepares service record: Follows chart giving check points on all trouble-shooting work; shows services rendered and cost of parts installed.

Sales: Sells machines, parts and machine modernization kits.

IV. Experimental Battery

All of the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion consisted of broad category supervisory ratings in the form of letter grades (A,B,C,D,and F) assigned by the Service Manager. Because of the longitudinal nature of the study it was considered advantageous to treat the group initially tested - and already employed at the time of initiation of the study - as subsample I (N=35). All Service Engineers subsequently hired and tested were assigned to Subsample II (N=15). The first ratings for Subsample I were made in December 1958 and the second were obtained in March 1959. For the remaining 15 workers, who make up Subsample II, initial ratings were obtained in March 1960 and reratings were obtained in April 1960.

Table III shows the total number assigned to each broad category for each subsample.

TABLE III

Numbers of Subjects Assigned to Different Broad Categories

Rating	High	Average	Low	Totals
Subsample I	9	15	11	35
Subsample II	6	5	4	15
Totals	15	20	15	50

These broad category ratings were converted to broad numerical scores for purposes of computation of correlation coefficients. This conversion gave 38 as a numerical score for low criterion, 50 for average, and 62 for high. The critical criterion score then became 39.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - Required to learn trouble-shooting techniques and procedures, to diagnose and correct malfunctions of machine operations, and in preparing and interpreting reports and instructions. Also used in computing costs for customers and to estimate machine requirements to fit customers' needs.

Numerical Aptitude (N) - Required in computing costs of materials and services.

Spatial Aptitude (S) - Needed to visualize machine parts and their effect in proper machine operation and setup. Also needed for relating malfunctions to service charts and procedures.

Manual Dexterity (M) - Necessary to handle tools and parts during disassembly, repair, adjustment, and operation of machines.

On the basis of the job analysis data, no aptitudes were considered irrelevant.

B. Quantitative Analysis:

Table IV shows the means, standard deviations, and Pearson product-moment correlations (corrected for broad categories) with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE IV

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion (c^r) for the Aptitudes of the GATB

N = 50

Aptitudes	M	σ	c^r
G-Intelligence	108.6	12.3	.435**
V-Verbal Aptitude	103.0	14.0	.360*
N-Numerical Aptitude	103.6	13.7	.467**
S-Spatial Aptitude	112.1	16.9	.229
P-Form Perception	102.4	16.3	.376**
Q-Clerical Perception	102.9	14.5	.319*
K-Motor Coordination	101.1	13.8	.296*
F-Finger Dexterity	109.7	18.2	.223
M-Manual Dexterity	111.7	21.6	.287*

**Significant at the .01 level
*Significant at the .05 level

Aptitudes S, F and M have the highest mean scores and Aptitudes G, V, N and K have relatively low standard deviations.

For a sample of 50 cases, correlations of .361 and .279 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G, N and P correlate significantly with the criterion at the .01 level. Aptitudes V, Q, K and M correlate significantly with the criterion at the .05 level.

C. Selection of Test Norms

TABLE V

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X					X
Irrelevant									
Relatively High Mean				X				X	X
Relatively Low Sigma	X	X	X				X		
Significant Correlation with Criterion	X	X	X		X	X	X		X
Aptitudes to be considered for trial norms	X	X	X	X	X	X	X		X

Trial norms consisting of various combinations of three and four of Aptitudes G, V, N, S, P, Q, K and M with appropriate cutting scores were evaluated against the criterion by means of the tetrachoric correlation technique. A comparison of the results showed that B-1002 norms consisting of G-95, S-85 and M-85 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing a tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing as close as possible to one-third of the sample in the low criterion group. A criterion critical score of 38 was used and resulted in 15 of the workers or 30 percent of the sample being placed in the low criterion group.

Table VI shows the relationship between test norms consisting of Aptitudes G, S, and M with critical scores of 95, 85, and 85 respectively, and the dichotomized criterion for Service Engineer 5-83.988. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE VI

Validity of Test Norms for Service Engineer 5-83.988

(G-95, S-85, M-85)

N = 50

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	30	35
Poor Workers	11	4	15
Total	16	34	50

$r_{tet} = .81$ $\quad X^2 = 14.220$

$\sigma_{r_{tet}} = .24$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes G, S, and M with minimum scores of 95, 85, and 85 respectively, have been established as B-1002 norms for the occupation of Service Engineer 5-83.988. The equivalent B-1001 norms consist of G-100, S-90, M-90.

IX. Determination of Occupational Aptitude Patterns

Of the existing 35 OAP's, a significant relationship between OAP-10 and the criterion for the experimental sample was obtained. The proportion of the sample screened out by OAP-10 was .32, which is within the required range of .10 to .60. Therefore, the occupation Service Engineer 5-83.988 will be allocated to OAP-10(35 OAP's; Revised 10/61).